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line of vision go from *s* to *s'*? It may happen to, but certainly this move is only one of indefinitely many possible moves. Mathematically, the chances of its moving to some other point are indefinitely great. And logically there is no reason why the move should be from *s* to *s'*. Thus it comes about that *the eye actually follows a trajectory in a series of discontinuous tangentials and by the well-known method of trial and error.* As the object moves, the line of vision shifts, usually to some point whither the object does not go. In a very short time this deflective move is checked by off-center vision of the object, as it progresses in some other direction than that taken by the eye. And the eye returns to catch the trial.

All this, I would urge, is the only conceivable mode of perception, if the objective situation really is as geometry and physics and biology describe it. And it explains both the eye's behavior and our preference for the *real* resting points as symbols of a moving thing.

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REVIEWS AND ABSTRACTS OF LITERATURE

Fortschritte der Psychologie und ihrer Anwendungen. 1 Band, VI Heft. KARL MARBE. Inhalt: (1) *Psychologische Gutachten zum Prozess wegen des Müllheimer Eisenbahnunglücks.* Pp. 35. (2) *Kinderaussagen in einem Sittlichkeitsprozess.* Pp. 22. Leipzig: Verlag von B. G. Teubner.

Here are some practical applications of psychology which may have, in their future development, an even more direct bearing upon social welfare than those commercial applications so interestingly commended by Professor Münsterberg in his recent book.

Dr. Marbe, director of the Psychological Institute at Würzburg, was called in as an expert in two cases here reported together, but widely different in character, as their titles will indicate. In the railroad case he was called in by the prosecution; in the other, by the defense. In both cases his side won the verdict. Moreover, it is evident to any one who will read the reports that his expert knowledge was of great importance in influencing the judgment of the court. Insanity experts have become a byword among us. Some would pray to be delivered from a new set of psychology experts; but if all can be as sane and as restrained as Professor Marbe we need not fear.

Case one is concerned with a railroad accident at Müllheim, Baden, when fourteen people were killed, many injured, and much property was destroyed. Contrary to expectation in such cases, the locomotive engineer, the fireman, and the guard (Zugfahrer) were not killed. Their examination upon the subject of the accident began at once.

In general outline the accident is known to all of us through similarity to railroad accidents in the United States. It was the old story of running past signals, neglect of instructions, and a liberal indulgence in beer, wine, and spirits during the engineer's day's run. It was discovered, also, that the engineer suffered from *incipient* arterial sclerosis of the brain; but this seems to have been opportunely discovered by the defense. The engineer ran into the station at Müllheim disregarding all signals (and German stations are plentifully supplied with them) on to a switch which led abruptly from the main track through a tunnel in the station building, at a speed of one hundred kilometers; whereas twenty kilometers was the prescribed rate for that switch. He had been manifestly "queer" and stupid all day,[1] so that the guard had remarked it; yet neither he nor the fireman, while they knew the danger and their own responsibility under the laws of Baden, did anything to prevent the disaster, except that the fireman shut off steam before the disaster without, however, applying the emergency brake. The guard had attempted to apply the emergency brake too late, and, in his panic, failed, as an investigation after the accident showed.

The state's attorney called upon Dr. Marbe to answer as an expert such questions as the following:

(*a*) (1) Was the fatigued condition of the engineer noticeably greater than that which might have been induced by his labor, the unusual heat (July 17), his incipient sclerosis, etc. (2) Did the use of alcohol weaken his sense of obligation to attend to the progress and safety of his train?

(*b*) Had the guard time in 22 seconds[2] (1) To recognize the ineffectiveness of his engineer, (2) To become clear in his mind that the train was in danger, (3) To bethink him of his duty to interfere, (4) To decide for the emergency brake, and (5) To pull this?

(*c*) How many seconds did the fireman need (1) To represent to himself the delay of the engineer, (2) To become clear as to his own responsibility to avert danger, (3) To decide for the emergency brake, (4) To pull this? and, in view of the fact that the emergency brake should immediately follow shutting off steam (which had taken place), (5) How much time would it take to apply the brake after shutting off the steam?

I may not take time and space to recount the details of the report which covers many pages of a sane, careful, well-balanced investigation: one highly calculated to raise applied psychology in the estimation of public men, especially members of law courts; but a few main points may be indicated.

(*a*) The exact amount of spirituous liquors consumed by the engineer within eighteen hours was ascertained—how, the report does not say. The engineer was certainly a capacious person! This came to a total which on the basis of the usual percentage of alcohol to be found in the various beverages consumed, was put at 178.3 grams of alcohol; and by citing various experiments it was shown pretty conclusively that such an amount would produce even upon a hardened drinker that "tired feeling," sleepiness, and an inhibition of the ordinary reflexes for twenty-four hours or more. In fact, so far as this part of the investigation is concerned, the conditions are too well known to need any comment or any further weight of authority.

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[1] It was known by his guard that he had consumed a large quantity of various alcoholic beverages during the day, but this did not seem to function as a cause of queerness and dumbness.

[2] Had steam been shut off and the emergency brake applied 15 meters before reaching the station signal, the train would have slowed down before the danger-point, and the accident been averted. The estimated time which elapsed between that point and the entrance to the switch was 22 seconds.

The expert psychologist here, as in the whole investigation, declined to enter into the moral judgments or to give causes for the accident; he confined himself to his psychology.

(*b*) More significant is the attention called to the effect of alcohol upon the ordinary power of inhibition which would, in normal conditions, have so influenced the engineer that, even had he been suffering unduly from the heat, illness, etc., he would yet have made an effort to look aften the safety of his train.[3]

(*c*) In order to answer the questions relating to the amount of time needed to set brakes, shut off steam, awaken to a sense of responsibility (which would quicken reaction time), etc., etc., the expert had recourse to simplified apparatus in his laboratory, by means of which the essential characteristics of the situation on the wrecked train were reproduced and, as a result of experiments conducted with many persons and instruments measuring very small fractions of a second, it was shown that the time necessary for the guard to observe that the engineer was not fulfiling his duty and then to apply the brake himself, did not exceed 2.5 seconds.

Here the author has, wisely, taken some pains to show that a consciousness process covers a much shorter interval of time than the expression of it. The guard did not need to reflect upon this situation in *words* in order to recognize it.

Allowing for some situation arising for which the guard (or the fireman) could not have been prepared, we add an extra second of time, although some allowance had already been made. Making still further allowance for safety's sake, the total time needed (as shown in the questions of the state's attorney) could not exceed four seconds, whereas there were 22 seconds available.[4] The defense objected that such measurements were all very well for the quiet of the laboratory, but that they could not hold good in actual practise. Amusing ignorance of reaction time was shown—perhaps the expert referred to tenths of a minute! This led to a desire on the part of Dr. Marbe to perform at least a part of the experiment in an actual locomotive of the same type as the one destroyed, with a *Packwagen* for the guard. Such an experiment was carried out through the courtesy of the railroad. The experimenter employed as subjects the regular train crew and used a stop-watch measuring fifths of a second. Results of this experiment triumphantly vindicated the accuracy and propriety of laboratory methods.

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[3] Note also the following points made: ''Die Art und Weise und wahrscheinlich auch die Zeitpunkt, in welchem der Lokomotivführer seinem Schlafbedurfnis nachgab-diese Dinge waren auf jeden Fall von dem Alkoholgenuss kausal beeinflusst. War nun aber der Alkohol eine ''erhebliche'' Ursach des Umstandes, dass der Lokomotivführer seinem Schlafbedurfnis nachgab. Das heisst: Hätte der Lokomotivführer nicht vielleicht seinem Schlafbedürfnis auch nachgegeben, wenn es gar keinen Alkohol getrunken hätte? Die Frage, ob der Alkoholgenuss ein erhebliche Ursache für die Nachgiebigkeit des Lokomotivführers gegenüber seinem Schlafbedurfnis war, muss ich mit der allergrössten Wahrscheinlichkeit bejahen.'' S. 349.

[4] Two other points are to be noticed: (1) Laboratory experiments are made under conditions of moderate attention only. In actual operation of a train much greater attention is normally to be expected. (2) *Cf.* page 359 of the *Fortschritte.* Observe that the guard may have for years entertained a contempt

This accident occurred on a Monday, according to criminal statistics one of the worst days of the week for reprimands; and its connection with the consumption of alcohol is most significant. Dr. Marbe suggests the manifest duty of railroads to require abstinence from their employees.[5]

As a result of this trial, the engineer was sentenced to two years and four months' imprisonment and costs, the guard received six months and costs, and the fireman merely had to pay the costs, it being considered by the court that the duties of his position were such as to give reasonable excuse for his failure to notice that the engineer had run by the signals.

In the second investigation here reported an unmarried schoolmaster of forty years of age was charged with criminal immorality with seven girl pupils, ten and eleven years of age. The accusation was made originally through anonymous letters, and corroborated by the girls in question at an examination held by the pastor of the village (Pfarrer) who, in Bavaria, is a local school inspector. Later, another examination was made by the police, and in both of these examinations the method of questioning was one which is very startling to Americans. The children were not asked to tell direct stories of what had occurred, but leading and intimate questions of a most revolting character were asked and were to be answered by "yes" or "no." Some of the questions could hardly have been understood by the children, while in others, the power of suggestion was great and fairly demanded false answers. The testimony of children and of young girls approaching puberty, in particular, especially when it relates to sexual matters, is notoriously unreliable. When combined, as here, with this unspeakable method of extracting testimony, the result is shocking indeed. A desire to do away with such methods of investigation is the excuse offered by Dr. Marbe for the nauseous details of this report,

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for printed directions, ''that sort of instruction,'' as emanating from people who knew nothing about the matter. He may have been encouraged in his belief by the number of trips taken, free from accident, when yet instructions had been disregarded. In the recent New Haven wreck case, testimony was abundant that running by signals, even in a fog, was common practise.

[5] In this connection note that the great wave of prohibition which has recently swept over the Southern States of this country has been caused by industrial conditions, not morals. Cotton manufacturers and others have found that, under prohibition, they get their workmen back on Monday morning as good as new!

details, the publication of which would be permitted in this country only to medical journals of limited circulation.

The charges were most specific and revolting—always understood that they were not volunteered, but elicited—yet the teacher was triumphantly acquitted by the court on the ground that such testimony was wholly unreliable. Much of it was withdrawn by the girls after they had realized its seriousness, and practically all of it could be traced to two girls (one in particular, whose character was quite untrustworthy and who had infected the others). By suggestion the girls were brought to believe that they had suffered acts of which they had merely heard. Physical examination showed that the outrages to which they had testified had not been committed.

The schoolmaster had not been popular in the village. Moreover, he had manifested at times a reprehensible, but not criminal familiarity of conduct with his pupils. Malicious gossip did the rest.

Of chief significance for us are these points: (1) The services of a trained psychologist, who knew the value of testimony, were called for; and it is his recommendation that there should be present such a trained taker of testimony at every examination and that both questions and answers be taken stenographically. (2) The verdict was influenced by this expert judgment. (3) The value of concurrent testimony was again weakened. (4) Certain reforms in question-putting were demanded. Even in this country undue weight is attached to the testimony of perverted or abnormal children. "For of such is the kingdom of heaven!" One hates to part with such an illusion—but illusion it surely is. All childish testimony is untrustworthy and much of it is bad, if anything is bad.

From the point of view of applied psychology these two cases show how the psychologist may be of signal service to courts without going beyond the proper confines of his profession. The moral aspect of these cases it is more difficult to estimate. In the railroad case some of the proper delinquents received adequate punishment which they have too often escaped, both in this country and abroad—but notably, here. It would be a good thing for the general public if as careful and able an expert could be called in to investigate some recent railroad horrors with a view to fixing responsibility with accuracy, but, after all, society desires not so much to punish the guilty as to avoid future disasters. From this point of view railroad authorities would do well to study the physiological effects of alcohol on reaction times. While railroad employees in this country are not so much given to drinking as those in Germany, there is ample room for improvement.

As to the case of alleged immorality: Doubtless many an innocent man has been condemned upon the testimony of youthful neurotics just because the testimony was clear cut and consistent. Since we now know how false this can be it behooves us to avoid the error.[6]

In the railroad case the court held all three men to have been guilty as charged; but, though fourteen people were killed and many injured, the sentences were not at all those appropriate to manslaughter. This is evidence that society apparently fears less the man who may kill scores or hundreds through besottedness or brutal stupidity than it does one revengeful person with a hot temper. But is society wise?

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[6] Psychologists and moralists should own the entire report and study it. Its scientific character is beyond question.

In the schoolmaster's case, he was justly acquitted of a charge which, had it been sustained, would have brought upon him severest punishment, removal from his place and the ruin of his career; but it is not clear that, even then, anything could have been accomplished to prevent future evils of the same kind.

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Das Weltproblem. J. PETZOLDT. Zweite Auflage. Leipzig und Berlin: B. G. Teubner. 1912. Pp. xii + 210.

This book is so suggestive and interesting that a second review of it will not be superfluous.[1] It is a small book on a great theme, a thing to be grateful for, and it is written with enthusiasm for a fine cause. That cause is twofold, the emancipation of our imagination from an academic tradition, and loyalty to a too little known thinker, Richard Avenarius. Readers of Avenarius, particularly of "der menschliche Weltbegriff," will find much that they are familiar with, especially the theory of "introjection," to which Petzoldt gives a more extensive application. This rehandling of the theory of introjection is of particular interest. There has been, we may say, a first and a second introjection; the first was the introjection of spirits, the second was the introjection of substance. The first was described by Avenarius, who calls our attention to the fact that primitive folk take quite naturally for granted, not as theoretical inferences, but as simply and normally experienced, the existence of *mana,* souls, spirits, and gods, and that much recent and contemporary philosophical confusion has resulted from the fact that, to a certain important extent, we operate unconsciously with an intellectual apparatus derived from animistic sources. In what we call conventionally "primitive culture" imagination seems to be mass imagination; there is no individual inquiry. The tales about things in general are instances of local mythology.

To break through this crust of aministic preconception requires a remarkable individual or a series of happy circumstances. Petzoldt takes the name of Thales as that of the first empiricist and positivist. For to substitute any "*Urstoff,*" provided by nature for the ἀρχαί of mythology was to be, in spirit, at least, an empiricist and a positivist. But the appeal from spirit to matter involved its own fatality, namely, the distinction between the screen of empirical "accidents" and the substance that hides behind them, together with the attribution of importance to the latter. The artifice of every philosophy that seeks the heart of things by an "*Aufhebung*" of empirical nature is prepared for in the introjection of substance.

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[1] The first edition was reviewed in this JOURNAL, Vol. IV., page 582, by Professor C. H. Rieber.